

A Projects, Organization, Structure, Members and Participants of the Collaborative Research Center 568

A.1 Research Projects

Project Area A: Injection Systems and Mixture Formation

Project no.	Title	Project leader	Funding period
A1	Aerodynamische Stabilität von verdrahten Airblast-Zerstäubern <i>Aerodynamic stability of swirled airblast atomizers</i>	C. Tropea	20012007
A1	Primärzerstäubung eines Gasturbinenzerstäubers <i>Primary droplet breakup in a gas turbine atomizer</i>	C. Tropea I. Roisman	20082011
A2	Numerische und experimentelle Untersuchungen der Filmerwärmung und Filmverdampfung in LPP-Kammern <i>Numerical and experimental investigation of heating and evaporation in a thin liquid film of a LPP chamber</i>	P. Stephan	20012007
A2	Experimentelle und numerische Untersuchungen der Filmströmung und Filmverdampfung an festen Wänden <i>Numerical and experimental investigation of fluid flow and evaporation in a thin liquid film on solid walls</i>	P. Stephan	20082011

Project no.	Title	Project leader	Funding period
A3	Modellierung von Tröpfchenwechselwirkungen <i>Modelling of droplet interactions</i>	E. Gutheil	20012007
A4	Thermodynamisch konsistente Modellierung der Tropfen-Turbulenz-Wechsel-wirkung in Gasturbinen-Sprays <i>Thermodynamically consistent modelling of droplet-turbulence interaction in gas turbine sprays</i>	A. Sadiki A. Dreizler	20012003
A4	Thermodynamisch konsistente Modellierung von Gastrubinen-Sprays <i>Thermodynamically consistent modelling of gas turbine sprays</i>	A. Sadiki A. Dreizler	20042011

Project Area B: Combustion

Project no.	Title	Project leader	Funding period
B1	Verlöschen partiell vorgemischter Flammen unter Gasturbinenbedingungen <i>Extinction of partially premixed flames under gas turbine conditions</i>	A. Dreizler J. Janicka	20012003
B1	Verlöschen vorgemischter und partiell vorgemischter Flammen unter Gasturbinenbedingungen <i>Extinction of premixed and partially premixed flames under gas turbine conditions</i>	A. Dreizler	20042007
B1	Transiente Prozesse in turbulenten Flammen unter Gasturbinenbedingungen <i>Transient processes in turbulent flames under gas turbine conditions</i>	A. Dreizler	20082011
B2	Vereinfachte Reaktionsmodelle für die Verbrennung in Gasturbinenbrennkammern <i>Reduced reaction models for combustion in gas turbine combustors</i>	J. Warnatz U. Riedel	20012011
B3	Grobstruktursimulation von Verbrennungssystemen unter Gasturbinenbedingungen <i>Large eddy simulation of combustion systems under gas turbine conditions</i>	J. Janicka	20012011

Project no.	Title	Project leader	Funding period
B4	Entwicklung eines vereinfachten Modells für die Rußbildung in Gasturbinenbrennkammern <i>Development of a simplified soot model in gas turbine combustors</i>	J. Warnatz U. Riedel	20012011
B5	Vorgemischte turbulente Verbrennung: Analyse und Modellbildung auf der Basis der Symmetrien der G-Gleichung <i>Premixed turbulent combustion: analysis and modelling on the basis of symmetries in the G-equation</i>	M. Oberlack	20012007
B5	Vorgemischte turbulente Verbrennung: Analyse und Modellierung zu verallgemeinerten Randbedingungen der G-Gleichung <i>Premixed turbulent combustion: analysis and modelling in the context of generalized boundary conditions of the G-equation</i>	M. Oberlack	20082011

Project Area C: Interaction and Fluid-Mechanical Processes

Project no.	Title	Project leader	Funding period
C1	Experimentelle und numerische Untersuchungen zur Wirkung des Verdichters auf die Brennkammereinströmung <i>Experimental and numerical investigation on the impact of the compressor on the combustion chamber inlet flow</i>	B Stoffel	20012003
C1	Experimentelle und numerische Untersuchungen der Wechselwirkung zwischen Verdichter und der Brennkammerströmung <i>Experimental and numerical investigation on the interaction of the compressor and the combustion chamber flow</i>	B Stoffel	20042007
C2	Strömung und Mischung im Primärzonenbereich von Gasturbinenbrennkammern <i>Flow and mixing in the primary zone of gas turbine combustors</i>	C. Tropea D. Hennecke	20012007

Project no.	Title	Project leader	Funding period
C3	Numerische Modellierung konvektiver Wärmeübertragung in Gasturbinenbrennkammern unter Berücksichtigung wandnaher Turbulenz <i>Numerical modelling of convective heat transfer in gas turbine combustors considering the influence of near wall turbulence</i>	S. Jakirlić C. Tropea	20012011

Project Area D: Cross-Sectional Projects

Project no.	Title	Project leader	Funding period
D1	Entwicklung und Analysis numerischer Verfahren für kompressible, reaktive Gleichungen der Strömungsdynamik und Strahlungstransportgleichungen <i>Development and analysis of numerical procedures for compressible reactive equations of fluid dynamics and radiative transport</i>	A. Klar R. Pinnau	20012003
D1	Entwicklung und Analysis numerischer Verfahren für die Strahlungstransportgleichungen und Kopplung an strömungsdynamische Gleichungen <i>Development and analysis of numerical procedures for radiative transport equations and their coupling to fluid dynamical equations</i>	A. Klar R. Pinnau	20042007
D2	Effiziente numerische Verfahren zur Berechnung turbulenter reaktiver Strömungen <i>Efficient numerical procedures to simulate turbulent reactive flows</i>	M. Schäfer	20012007
D2	Effiziente numerische Verfahren zur Berechnung und Optimierung turbulenter reaktiver Strömungen <i>Efficient numerical procedures to simulate and optimize turbulent reactive flows</i>	M. Schäfer	20082011

Project no.	Title	Project leader	Funding period
D3	Integrales Modell zur Simulation von Gasturbinenbrennkammern <i>Integral model for the simulation of gas turbine combustors</i>	M. Schäfer J. Janicka	20012011
D4	Adaptive Fehlerkontrolle bei der Grobstruktursimulation <i>Adaptive error control in the context of large eddy simulation</i>	J. Lang	20042007
D4	Adaptive Qualitätskontrolle bei der Grobstruktursimulation <i>Adaptive quality control in the context of large eddy simulation</i>	J. Lang	20082011
D5	Effiziente numerische Multilevel-Verfahren zur Optimierung von Gasturbinenbrennkammern <i>Efficient numerical multi-level procedures for the optimization of gas turbine combustors</i>	S.Ulbrich	20082011

Project Area T: Transfer Projects

Project no.	Title	Project leader	Funding period
T1	Fortschrittliche Auslegungsgrundlagen für Fluggasturbinenbrennkammern <i>Advance design principles for aero engine combustors</i>	J. Janicka	20052009
T2	Grobstruktursimulation von Zweiphasen-Strömungen und Vormischflammen für Verbrennungsmotoren <i>Large eddy simulation of two-phase flow and premixed flames for internal combustion engines</i>	J. Janicka A. Sadiki	20072011
T3	Bildgebende laseroptische Messverfahren zur Auslegung von Saugrohreinspritzungen in Ottomotoren <i>Laser imaging diagnostics for the design of intake-manifold fuel injection in gasoline engines</i>	A. Dreizler	20072011

Project no.	Title	Project leader	Funding period
T4	Hochgeschwindigkeits-Laser-Diagnostik zur Untersuchung von Zyklusschwankungen von Verbrennungskraftmaschinen <i>High-speed laser diagnostics for the investigation of cycle-to-cycle variations of IC engine processes</i>	A. Dreizler	20082011

Project Area Z: Administrative Tasks

Project no.	Title	Project leader	Funding period
Z1	Zentrale Aufgaben des Sonderforschungsbereichs <i>Central tasks of the Collaborative Research Center</i>		20012011

A.2 Scientific Committee

Members

Prof. Dr. rer. nat. Andreas Dreizler
 Prof. Dr. rer. nat. Eva Gutheil
 Prof. Dietmar K. Hennecke, Ph.D.
 Prof. Dr. Ing. Suad Jakirlic
 Prof. Dr. Ing. Johannes Janicka
 Prof. Dr. rer. nat. Axel Klar
 Prof. Dr. Jens Lang
 Prof. Dr.-Ing. Martin Oberlack
 Prof. Dr. rer. nat. René Pinnau
 PD Dr. rer. nat. Uwe Riede
 PD Dr.-Ing. Ilias Roisman
 PD Dr.-Ing. Tatiana Gambaryan-Roisman
 Prof. Dr. rer. nat. Amsini Sadiki
 Prof. Dr. rer. nat. Michael Schäfer
 Prof. Dr.-Ing. Peter. Stephan
 Prof. Dr.-Ing. Bernd Stoffel
 Prof. Dr.-Ing. Cameron Tropea
 Prof. Dr. rer. nat. Stefan Ulbrich
 Prof. Dr. rer. nat. Jürgen Warnatz

Chairman

Prof. Dr. Ing. Johannes Janicka

Vize-Chairman

Prof. Dr. rer. nat. Michael Schäfer

Scientific Coordinator

Prof. Dr. rer. nat. Amsini Sadiki

A.3 Visiting Researchers

Dr. Robert Barlow	2003
<i>Sandia National Laboratories, USA</i>	
Prof. Ismail Celik	2005
<i>West Virginia University, USA</i>	2006
Prof. Satya R. Chakravarthy	2002
<i>IIT Madras, India</i>	2003
	2006
Dr. Mouldi Chrigui	2007
<i>Faculte des Sciences de Gafsa, Tunisia</i>	2008
	2009
	2010
	2011
Prof. P. Coelho	2004
<i>Technical University of Lisbon, Portugal</i>	
Prof. I. S. Ertesvåg	2007
<i>Norwegian University of Science and Technology Trondheim, Norway</i>	
Prof. S. Gogineni	2004
<i>Innovative Scientific Solutionis, Inc., USA</i>	
Prof. K. Hanjalic	2004
<i>Delft University of Technology, The Netherlands</i>	
Prof. T. Ishima	2001
<i>Grunma University, Kiryo City, Japan</i>	
Dr. H. Jasac	2004
<i>Nabla Ltd., UK</i>	
Prof. M. Kameda	2001
<i>Tokio University, Japan</i>	
Prof. W. Kollmann	2001
<i>Davis University of California, USA</i>	2010
	2011
Prof. G. Nathan	2006
<i>University of Adelaide, Australia</i>	

Prof. B. Özdemir	2001
<i>MET University, Ankara, Turkey</i>	2002
Prof. D. Veynante	2005
<i>Ecole Centrale de Paris, France</i>	

A.4 Financial Support by Means of the Deutsche Forschungsgemeinschaft

The Collaborative Research Centre 568 was supported by grants of the Deutsche Forschungsgemeinschaft totalling EUR 14,763,100.

Year	Grant (EUR)
2001 – 2003	3,195,600
2004	1,571,000
2005	1,322,000
2006	1,272,000
2007	1,494,000
2008	1.796.800
2009	1,366,600
2010	1,421,900
2011	1,298,200
2001–2011	14,763,100

B List of Project-Related Publications

B.1 Part I: Injection Systems and Mixture Formation

- Ahmad, W., Chrigui, M., Sadiki, A., Ngoma, G.D.: Effect of evaporation on the combustion behaviour of kerosene spray flame. ASME Turbo Expo 2010 (GT2010-22641), Glasgow, Scotland, UK, 14–18 June 2010.
- Batarseh, F., Gnirß, M., Roisman, I.V., Tropea, C.: Fluctuations of a spray generated by an airblast atomizer. *Exp. Fluids* **46**, 1081–1091 (2009)
- Chrigui, M., Roisman, I.V., Batarseh, F.Z., Sadiki, A., Tropea, C.: Spray generated by an airblast atomizer under elevated ambient pressures. *J. Propuls. Power* **26**, 1170–1183 (2009)
- Chrigui, M., Sadiki, A., Batarseh, F., Janika, J., Tropea, C.: Numerical and experimental study of spray produced by an airblast atomizer under elevated pressure conditions. In: ASME Conference Proceedings, vol. 3 (2008)
- Chrigui, M., Sadiki, A., Janicka, J., Zgahl, A.: Study of n-heptane spray evaporation and dispersion within premixed combustion in complex geometry configuration. In: Accepted to the 32th International Symposium on Combustion, McGill University, Montreal, Canada (2008)
- Chrigui, M., Sadiki, A., Janicka, J.: Numerical analysis of spray dispersion, evaporation and combustion in a single gas turbine combustor. In: ASME TURBO-EXPO, GT2008-51253, Berlin, Germany (2008)
- Chrigui, M., Batarseh, F.Z., Sadiki, A., Roisman, I., Tropea, C.: Numerical and experimental study of spray produced by an airblast atomizer under elevated pressure conditions. In: ASME TURBO-EXPO, GT2008-51305, Berlin, Germany (2008)
- Chrigui, M., Sadiki, A., Ngoma, G.D.: Unsteady, turbulent, two-phase flow using an Euler/Lagrange approach devoted to two-way coupling conditions. In: International Conference on Multiphase Flow 2010 (ICMF-2010), Florida, USA, 30 May–4 June 2010
- Chrigui, M., Hage, M., Sadiki, A., Janicka, J., Dreizler, A.: Experimental and numerical analysis of spray dispersion and evaporation in a combustion chamber. *At. Spray* **19**, 929–955 (2009)
- Chrigui, M., Roisman, I., Batarseh, F., Sadiki, A., Tropea, C.: Spray generated by an airblast atomizer under elevated ambient pressures. *J. Propuls. Power AIAA* **26**(6), 1170–1183 (2010)
- Chrigui, M.: N-Heptane spray evaporation and dispersion in turbulent flow within a complex geometry configuration. *J. Comput. Therm. Sci.* **2**(1), 55–78 (2010)
- Chrigui, M., Sadiki, A., Janicka, J.: Evaporation and dispersion of N heptane droplets within premixed flame. *J. Heat Mass Trans.* **46**(8–9), 869–880 (2010)
- Chrigui, M., Schneider, L., Zgahl, A., Sadiki, A., Janicka, J.: Droplet behavior within a LPP ambiance. *J. Fluid Dyn. Mater. Process.* **6**(4), 399–408 (2010)

- Chrigui, M., Moesl, M.K., Ahmadi, W., Sadiki, A., Janicka, J.: Partially premixed prevaporized kerosene spray combustion in turbulent flow. *Exp. Therm. Fluid Sci.* **34**(1), 308–315 (2010)
- Chrigui, M., Zghal, A., Sadiki, A., Janicka, J.: Spray evaporation and dispersion of n-heptane droplets within premixed flame. *Heat Mass Trans.* **46**, 869–880 (2010)
- Chrigui, M., Gounder, J., Sadiki, A., Masri, R., Janicka, J.: Partially premixed reacting acetone spray using LES and FGM tabulated chemistry combustion and flame. <http://dx.doi.org/10.1016/j.combustflame.2012.03.009> (2012)
- Hahn, F., Sadiki, A., Janicka, J.: Large eddy simulation of a particle laden swirling flow based on an Euler-Lagragian approach. In: 6th International Conference on Multiphase Flow (ICMF2007), Leipzig, Germany (2007)
- Helbig, K.: Messung zur Hydrodynamik und zum Wärmetransport bei der Filmverdampfung. EPDA Elektronische Publikationen Darmstadt. <http://elib.tu-darmstadt.de/diss/000867>. Accessed 7 Apr 2011
- Helbig, K., Alexeev, A., Gambaryan-Roisman, T., Stephan, P.: Evaporation of falling and shear-driven films on smooth and grooved surfaces. *Flow Turbul. Combust.* **75**, 85–104 (2005)
- Helbig, K., Nasarek, R., Gambaryan-Roisman, T., Stephan, P.: Effect of longitudinal mini-grooves on flow stability and wave characteristics of falling liquid films. *ASME J. Heat Trans.* **131**, 011601 (2009)
- Gambaryan-Roisman, T., Stephan, P.: Analysis of falling film evaporation on grooved surfaces. *J. Enhanc. Heat Trans.* **10**(4), 445–457 (2003)
- Gambaryan-Roisman, T., Alexeev, A., Stephan, P.: Effect of the microscale wall topography on the thermocapillary convection within a heated liquid film. *Exp. Therm. Fluid Sci.* **29**, 765–772 (2005)
- Gambaryan-Roisman, T., Stephan, P.: Flow and stability of rivulets on heated surfaces with topography. *ASME J. Heat Trans.* **131**(3), 033101 (2009)
- Kabova, Y., Alexeev, A., Gambaryan-Roisman, T., Stephan, P.: Marangoni-induced deformation and rupture of a liquid film on a heated microstructured wall. *Phys. Fluids* **18**, 012104 (2006)
- Kunkelmann, C., Ibrahim, K., Schweizer, N., Herbert, S., Stephan, P., Gambaryan-Roisman, T.: The effect of three-phase contact line speed on local evaporative heat transfer: experimental and numerical investigations. *Int. J. Heat Mass Trans.* **55**(7–8), 1896–1904 (2012)
- Löffler, K., Yu, H., Gambaryan-Roisman, T., Stephan, P.: Hydrodynamics and heat transfer of thin films flowing down inclined smooth and structured plates. In: Proceedings of the 4th International Berlin Workshop – IBW4 on Transport Phenomena with Moving Boundaries, Berlin (2007)
- Marati, J.R., Budakli, M., Gambaryan-Roisman, T., Stephan, P.: Heat transfer in shear-driven thin liquid film flows. In: Proceedings of CHT-12, ICHMT International Symposium on Advances in Computational Heat Transfer, Bath, England (Accepted) (2012)
- Olbricht, C., Hahn, F., Sadiki, A., Janicka, J.: Analysis of subgrid scale mixing using a hybrid LES-Monte-Carlo PDF method. *Int. J. Heat Fluid Flow* **28**(6), 1215–1226 (2007)
- Opfer, L., Roisman, I.V., Tropea, C.: High speed visualization of drop and spray impact on rigid walls with cross-flow, Poster. In: International Conference on Multiphase Flows, Tampa, USA (2010)
- Opfer, L., Roisman, I.V., Tropea, C.: Spray impact on walls with cross-flow, Poster. In: Workshop on Near Wall Reactive Flows, Seeheim, Germany (2010)
- Opfer, L., Roisman, I.V., Tropea, C.: Spray Impact on Walls with Cross-flow: Experiments and Modeling, ILASS Europe, Estoril, Lissabon (2011)
- Opfer, L., Roisman, I.V., Tropea, C.: Laboratory simulations of an airblast atomization: main mechanisms of liquid disintegration and spray characteristics. *Exp. Fluids*, submitted, March 2012
- Pantangi, P., Sadiki, A., Janicka, J., Hage, M., Dreizler, A., van Oijen, J.A., Hassa, C., Heinze, J., Meier, U.: LES of pre-vaporized kerosene combustion at high pressures in a single sector combustor taking advantage of the flamelet generated manifolds method. In: Proceedings of ASME Turbo Expo 2011 (GT2011-45819), Vancouver, Canada, 6–10 June 2011

- Roisman, I.V., Batarseh, F.Z., Tropea, C.: Chaotic disintegration of a liquid wall film: a model of an air-blast atomization. *Atomiz. Sprays* **20**(10), 837–845 (2010)
- Roisman, I.V., Batarseh, F.Z., Tropea, C.: Characterization of a spray generated by an airblast atomizer with prefilmer. *Atomiz. Sprays* **20**(10), 887–903 (2010)
- Sadiki, A., Goryntsev, D., Wegner, B., Janicka, J.: Design of technical combustion systems using LES: state of the art and perspectives. In: 7th International ERCOFTAC Symposium on Engineering. Turbulence Modelling and Measurements, (ETMM7), Limassol, Cyprus, 4–6 June 2008
- Sadiki, A., Ahmadi, W., Chrigui, M., Janicka, J.: Towards the impact of fuel evaporation-combustion interaction on spray combustion in gas turbine combustion chambers. Part I: effect of partial fuel vaporization on spray combustion. In: Merci, B., Roeckaerts, D., Sadiki, A. (eds.) *Proceedings of the 1st International Workshop on Turbulent Spray Combustion*, Chap. 3, pp. 111–132, Springer (2011)
- Sadiki, A., Ahmadi, W., Chrigui, M., Janicka, J.: Towards the impact of fuel evaporation-combustion interaction on spray combustion in gas turbine combustion chambers. Part II: influence of high combustion temperature on spray droplet evaporation. In: Merci, B., Roeckaerts, D., Sadiki, A. (eds.) *Proceedings of the 1st International Workshop on Turbulent Spray Combustion*, Chap. 3, pp. 111–132, Springer (2011)

B.2 Part II: Combustion

- Böhm, B., et al.: In-Nozzle measurements of a turbulent opposed jet using PIV. *Flow Turbul. Combust.* **85**, 73–93 (2010)
- Böhm, B., et al.: Simultaneous PIV/PTV/OH PLIF imaging: conditional flow field statistics in partially-premixed turbulent opposed jet flames. *Proc. Combust. Inst.* **31**, 709–718 (2007)
- Böhm, B., et al.: New perspectives on turbulent combustion: Multi-parameter high-speed laser diagnostics. *Flow Turbul. Combust.* **86**, 313–341 (2011)
- Böhm, B., et al.: Time-resolved conditioned flow field statistics in extinguishing turbulent opposed jet flames using simultaneous highspeed PIV/OH-PLIF. *Proc. Combust. Inst.* **32**, 1647–1654 (2009)
- Bork, B., et al.: 1D high-speed Rayleigh measurements in turbulent flames. *Appl. Phys. B* **101**, 487–491 (2010)
- Geyer, D., et al.: Finite rate chemistry effects in turbulent opposed flows: comparison of Raman/Rayleigh measurements and Monte Carlo PDF simulation. *Proc. Combust. Inst.* **30**, 711–718 (2005)
- Geyer, D., et al.: Scalar dissipation rates in isothermal and reactive turbulent opposed-jets: 1D-Raman/Rayleigh experiments supported by LES. *Proc. Combust. Inst.* **30**, 681–689 (2005)
- Geyer, D., et al.: Turbulent opposed-jet flames: a critical benchmark experiment for combustion LES. *Combust. Flame* **143**, 524–548 (2005)
- Gregor, M.A., et al.: Multi-scalar measurements in a premixed swirl burner using 1D Raman/Rayleigh scattering. *Proc. Combust. Inst.* **32**, 1739–1746 (2009)
- Ketelheun, A., Olbricht, C., Hahn, F., Janicka, J.: NO prediction in turbulent flames using LES/FGM with additional transport equations. *Proc. Combust. Inst.* **33**(2), 2975–2982 (2011)
- Ketelheun, A., Aschmoneit, K., Janicka, J.: CO prediction in LES of turbulent flames with additional modeling of the chemical source term. In: *ASME Turbo Expo*, Copenhagen, Denmark, accepted for publication, 11–15 June 2012
- Kuehne, J.: Analysis of combustion LES using an Eulerian Monte Carlo PDF method. PhD thesis, TU Darmstadt (2011)
- Kuehne, J., Ketelheun, A., Janicka, J.: Analysis of sub-grid PDF of a progress variable approach using a hybrid LES/TPDF method. *Proc. Combust. Inst.* **33**, 1411–1418 (2011)

- Kuenne, G., Ketelheun, A., Janicka, J.: LES modeling of premixed combustion using a thickened flame approach coupled with FGM tabulated chemistry. *Combust. Flame* **158**, 1750–1767 (2011)
- Lebiedz, D.: Computing minimal entropy production trajectories: an approach to model reduction in chemical kinetics. *J. Chem. Phys.* **120**(15), 6890–6897 (2004)
- Lebiedz, D.: Entropy-related extremum principles for model reduction of dynamical systems. *Entropy* **12**(4), 706–719 (2010)
- Lebiedz, D., Reinhardt, V., Kammerer, J.: Novel trajectory based concepts for model and complexity reduction in (bio)chemical kinetics. In: Gorban, A.N., Kazantzis, N., Kevrekidis, I.G., Theodoropoulos, C. (eds.) *Model Reduction and Coarse-Graining Approaches for Multi-scale Phenomena*, pp. 343–364. Springer, Dordrecht (2006)
- Lebiedz, D., Reinhardt, V., Siehr, J.: Minimal curvature trajectories: Riemannian geometry concepts for slow manifold computation in chemical kinetics. *J. Comput. Phys.* **229**(18), 6512–6533 (2010)
- Lebiedz, D., Reinhardt, V., Siehr, J., Unger, J.: Geometric criteria for model reduction in chemical kinetics via optimization of trajectories. In: Gorban, A.N., Roose, D. (eds.) *Coping with Complexity: Model Reduction and Data Analysis*, pp. 241–252. Springer, Berlin (2010)
- Lebiedz, D., Siehr, J., Unger, J.: A variational principle for computing slow invariant manifolds in dissipative dynamical systems. *SIAM J. Sci. Comput.* **33**(2), 703–720 (2011)
- Nauert, A., et al.: Experimental analysis of flash back in lean premixed swirling flames: conditions close to flash back. *Exp. Fluids* **43**, 89–100 (2007)
- Nauert, A., Dreizler, A.: Conditional velocity measurements by simultaneously applied laser Doppler velocimetry and planar laser-induced fluorescence in a swirling natural gas/air flame. *Z. Phys. Chem.* **219**, 635–648 (2005)
- Omar, S.K., et al.: Investigation of flame structures in turbulent partially premixed counter-flow flames using laser-induced fluorescence. *Prog. Comput. Fluid Dyn.* **4**, 241–249 (2004)
- Reinhardt, V., Winckler, M., Lebiedz, D.: Approximation of slow attracting manifolds in chemical kinetics by trajectory-based optimization approaches. *J. Phys. Chem. A* **112**(8), 1712–1718 (2008)
- Schneider, C., Dreizler, A., Janicka, J.: Fluid dynamical analysis of atmospheric reacting and isothermal swirling flows. *Flow Turbul. Combust.* **74**, 103–127 (2005)
- Siehr, J., Lebiedz, D.: An optimization approach to kinetic model reduction for combustion chemistry. Submitted (2012)

B.3 Part III: Interaction and Fluid-Mechanical Processes

- Jakirlić, S., Hanjalić, K.: A new approach to modelling near-wall turbulence energy and stress dissipation. *J. Fluid Mech.* **539**, 139–166 (2002)
- Jakirlić, S., Jester-Zürker, R., Tropea, C.: Joint effects of geometry confinement and swirling inflow on turbulent mixing in model combustors: a second-moment closure study. *J. Prog. CFD* **4**(3–5), 198–207 (2004)
- Jakirlić, S., Eisfeld, B., Jester-Zürker, R., Kroll, N.: Near-wall, Reynolds-stress model calculations of transonic flow configurations relevant to aircraft aerodynamics. *Int. J. Heat Fluid Flow* **28**(4), 602–615 (2007)
- Jakirlić, S., Kniesner, B., Kadavelil, G., Gnirß, M., Tropea, C.: Experimental and computational investigations of flow and mixing in a single-annular combustor configuration. *Flow Turbul. Combust.* **83**(3), 425–448 (2009)
- Jakirlić, S., Kadavelil, G., Kornhaas, M., Schäfer, M., Sternel, D.C., Tropea, C.: Numerical and physical aspects in LES and hybrid LES/RANS of turbulent flow separation in a 3-D diffuser. *Int. J. Heat Fluid Flow* **31**(5), 820–832 (2010)

- Jakirlić, S., Jovanović, J.: On unified boundary conditions for improved prediction of near-wall turbulence. *J. Fluid Mech.* **656**, 530–539 (2010)
- Jakirlić, S., Kniesner, B.: Near-wall RANS modelling in LES of heat transfer in backward-facing step flows under conditions of constant and variable fluid properties. In: ASME 3rd Joint U.S.-European Fluids Engineering Summer Meeting: Symposium on “DNS, LES and Hybrid RANS/LES Methods”, Montreal, Quebec, Canada, Paper No. FEDSM-ICNMM2010-30354, 1–5 August 2010
- Jakirlić, S., Jester-Zürker, R.: Convective heat transfer in wall-bounded flows affected by severe fluid properties variation: a second-moment closure study. In: ASME 3rd Joint U.S.-European Fluids Engineering Summer Meeting: “7th Symposium on Fundamental Issues and Perspectives in Fluid Mechanics”, Montreal, Quebec, Canada, Paper No. FEDSM-ICNMM2010-30729, 1–5 August 2010
- Jakirlić, S., Chang, C.-Y., Kadavelil, G., Kniesner, B., Maduta, R., Sarić, S., Basara, B.: Critical evaluation of some popular hybrid LES/RANS methods by reference to flow separation at a curved wall (invited lecture). In: 6th AIAA Theoretical Fluid Mechanics Conference, Honolulu, HI, USA, Paper No. AIAA-2011-3473, June 27–30 2010
- Jakirlić, S., Kniesner, B., Kadavelil, G.: On interface issues in LES/RANS coupling strategies: a method for turbulence forcing. *JSME J. Fluid Sci. Technol.* **6**(1), 56–72 (2011)
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